Information Technology and Organizational Learning Interplay: A Survey

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Abstract

The objective of this paper is to provide a systematic review of the evolutionary trends in the research domain of information technology and organizational learning. Having surveyed various journals and key conferences between 2000 and 2018 on the topic, we observe that *information technology (IT)* has expanded from its general form to various contemporary information systems, e.g. knowledge organization systems, communication and collaborative systems and decision support systems. However, *organization learning (OL)* now essentially occurs through knowledge management activities, e.g. knowledge acquisition, storing, sharing and application of knowledge. The survey reported here not only validates the interplay of IT and OL but also reveals some important intervening factors between IT and OL, e.g. absorptive capacity, organization culture, user trust, acceptance and satisfaction that work as deterministic elements in the reciprocal relationship of IT and OL. We propose future research to explore interaction between big data analytical systems and organizational learning.

Keywords organizational learning, information technology, knowledge management, information system, influential factors

1 Introduction

Information technology (IT) is an integral part of contemporary organizations which provides them a suitable platform for learning. Organizational learning (OL) is a way for continuous improvement of business processes and is achieved by management of tacit and explicit knowledge resources (Chadhar and Daneshgar 2018). Organizations learn and improve if there exists a mechanism for its employees to access required knowledge to run their daily activities. IT provides such mechanism within organization and it can be in different forms such as information systems, applications, hardware infrastructure and thus provides an infrastructure to acquire, retrieve and share data and information, which when processed in some specific context becomes knowledge, to its members to perform their organizational work (Broendsted and Elkjaer 2001). Hence, IT acts as a facilitator of knowledge management and ultimately triggers organizational learning. Information technology expedites the ability of the organizations to acquire new knowledge, transfer and represent this knowledge and apply it into their informed decision making, enhance their performance and gain competitive advantages over their counterparts. Nevertheless, organizations cannot achieve required benefits of IT, if they have not imbibed the necessary modalities to learn latest market trends, customer behaviours and competitors role (Tippins and Sohi 2003). OL plays a pivotal role in implementation, assimilation and utilization of IT to enhance organization performance and gain competitiveness (Cegarra-Navarro et al. 2007; Cho 2007; Lin and Lee 2005; Pebrianto and Djamhur 2013; Reardon and Davidson 2007; Roberts et al. 2017; Torkestani et al. 2014). Knowledge acquisition, dissemination, representation and application are the main constructs of OL which are supported by IT altogether or separately. Various researchers (Chadhar 2017; Garrido-Moreno and Padilla-Meléndez 2011; Ke and Wei 2006; Myreteg 2015; Peltier et al. 2013; Verwijs and Soekijad 2002) have demonstrated role of OL in implementation mainly in the context of success of Enterprise Resource Planning (ERP) and Customer Relationship Management (CRM) systems. Although information technology and organizational learning are known to work independently but inherently, it has been observed that they have an interactive and reciprocal relationship (Robey et al. 2000). Having surveyed various literature, we observe that IT has expanded from its general form to various contemporary information systems, in contrast to previous studies on the topic, which enhance organizational learning and in response, OL provides a mechanism to utilize the technology efficiently. Thus both IT and OL have interplay. There are also some factors, such as organization culture, environment, user acceptance and satisfaction which affect the interplay of IT and OL. The survey of the scholarly literature helped us to develop a framework, depicted in Figure 1 and according to best of our knowledge, there is no such framework available in the literature before. The figure illustrates the interplay of IT and OL by showing that IT enhances organization learning whereas OL supports information technology, including the factors influencing this relationship.

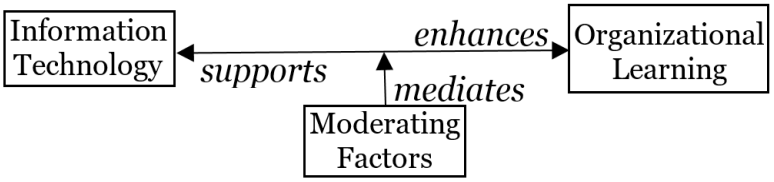

Figure 1: classification and relationship diagram of IT and OL (source: Developed for this research)

2 Methodology

We started our study to provide a systematic review of the evolutionary trends in the research domain of IT and OL to facilitate researchers and practitioners working to overcome implementation and utilization problems of information systems to increase their efficiency. Instead of being exhaustive and covering the entire domain of IT and OL, the survey aims to focus essentially on the interplay between IT and OL and the interceding factors which have influence on this interplay. To achieve this, we have chosen a specific criterion to select articles for this survey. Only recent (from January 2000 till July 2018) refereed journal and conference articles are included. The articles that emphasised certain terms in their title, such as "organizational learning" or any of its dimension and "information technology" or any of its application, are counted. Next, from the numerous databases available, we have restricted our search only to Scopus database because of its larger collection of scholarly journals and non-exhaustive nature of our study. With this restriction we have found 101 research articles. There is a small possibility that not all articles may get properly filtered and may thus escape in being included in this survey.

The survey is divided into four main categories: (i) Relationship between knowledge management and organizational learning, (ii) Studies that describe information technology as an enabler of organizational learning, (iii) Studies that treat organizational learning concepts to support information technology; and

(iv) Factors that affecting interplay between information technology and organizational learning. The survey reported here enables us to make specific conclusions about IT and OL and indicates some directions for future research reported by different authors in the literature.

3 Knowledge Management and Organizational Learning

All organizations need knowledge, tacit and explicit, to run their business effectively. Tacit knowledge is implicit and difficult to codify and imitate. While tacit knowledge can be found in the forms of skill and experience of employees. The explicit knowledge is formal and easy to access, articulate and codify in the form of electronic or paper documents. From the viewpoint of knowledge base theory, knowledge is power to remain successful in turbulent business world. Organizations put their maximum efforts to manage their internal and external knowledge to make it available to their employees to keep them more efficient and innovative in their roles. Knowledge management contributes significantly into organization performance. From information technology perspective, knowledge management serves to create, store, share and utilize knowledge (Ling 2011) . We can consider knowledge management to be an antecedent of organizational learning that is controlled by its manageable processes such as single and double loop learning and community of practice or both have same concern. Our viewpoint is supported by many researchers (Castaneda et al. 2018; Firestone and McElroy 2004; Spender 2008). We are of the opinion that whenever there is knowledge management within an organization there will certainly be an occurrence of organizational learning.

4 Information Technology for Organizational Learning

Information technology plays a very important role to make organizations efficient, to manage knowledge and learn quickly (Lopez-Nicolas and Soto-Acosta 2010; Mitić et al. 2017; Real et al. 2006; Tanriverdi 2005; Verwijs and Soekijad 2002). It provides a way to store and access required memory and knowledge rapidly by using internet, WWW, WAN, intranet or LAN and any other ICTs (Bennet and Shane Tomblin 2006; Chalmeta and Grangel 2008; Croasdell 2001). Organizations use various information systems for acquisition, retention, transfer and application of required knowledge to obtain competitive advantages and meet their objectives (Arias and Solana 2013; Baxter et al. 2009; Chou 2003; Davison et al. 2013; Hrastinski and Monstad 2014; Lyytinen and Rose 2006; Ruiz-Mercader et al. 2006). Janson et al. (2007) demonstrated role of information technology to support an organization to learn for successful transition from a socialist company to a privatized company. The similar concept is demonstrated by Cecez-Kecmanovic et al. (2010). We have categories information technology into knowledge organization systems, communication and collaborative systems and decision support system, figure 2. In the following sections, we have discussed how these information systems enhance organizational learning.

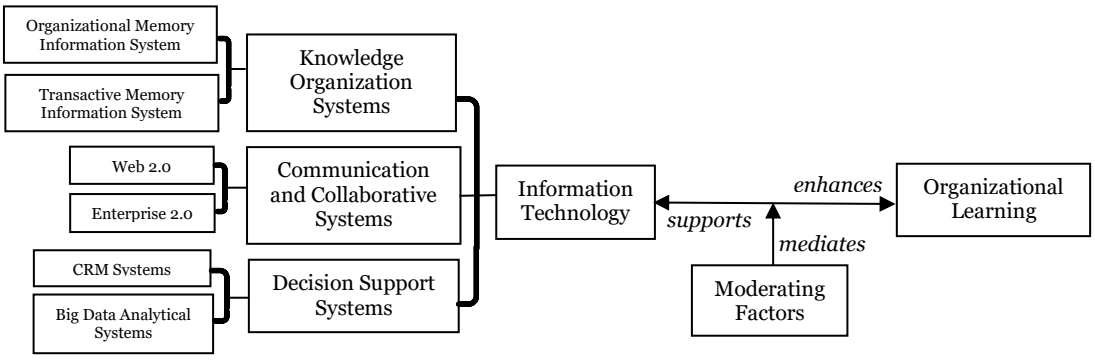

Figure 2: IT for OL (source: Developed for this research)

4.1 Knowledge Organization Systems

These are the technology based systems which are used to manage, store and retrieve knowledge to enhance learning experience of organization. We have categories knowledge support systems into knowledge management systems, organizational memory information systems and transactive memory information systems.

Knowledge management systems facilitates organizations to collect, store, share and apply knowledge to achieve productivity in business. They support organizational processes and routines and contribute into overall organizational learning process (Gasson and Shelfer 2007; Yıldırım 2017).

Organizational memory information systems such as databases, electronic bulletin boards, company yellow pages, intranet portals and knowledge repositories etc. provide means to organizations to access and protect their experiential knowledge to solve problems and perform better decisions making (Ji and Salvendy 2001; Olivera 2000). The systems keep knowledge available within organization when any employee leave the organization (Sudharatna 2015). Organizational memory systems initiate organizational learning through which employees reuse or gain new knowledge to perform their duties (Basaruddin et al. 2011).

Transactive memory information systems can be in the form of expertise directories, job description of employees, organizational organograms and social networks etc. that are digitally accessible to employees through information technology. These systems facilitate employees to know who knows what within organization and help them in improved tacit and explicit knowledge management and enhancing their learning experience and performance (Dunaway and Sabherwal 2012; Joy et al. 2012; Spraggon and Bodolica 2017; Wang et al. 2018; Zhang et al. 2012) . An organization can learn faster and perform better than an organization that has not established any transactive memory system (Argote 2015). Organizational knowledge is usually stored in organization routines and transactive memory system helps employees to know who knows what about those routines, thus promoting knowledge management among employees (Argote and Guo 2016).

4.2 Communication and Collaborative Systems

These are systems which facilitate collaboration and communication among employees, teams; virtual or distributed, or inter-organizations to acquire or share knowledge. E-collaboration among employees of an organization increases their productivity (Choi and Ko 2012). We have divided communication and collaboration into Web 2.0 tools and Enterprise social network systems.

Organizations use Web 2.0, social media technologies such as social websites, blogs, discussion forums etc., to increase collaboration and participation among employees to accomplish their tasks efficiently. Employees acquire and share knowledge through these tools and improve their learning experience and hence influence organizational learning for innovation, better performance and competitiveness (Boateng et al. 2009; Boateng et al. 2010; Huang and Güney 2012; London and Hall 2011; Menolli et al. 2017; Thomas and Akdere 2013; Zeng et al. 2015).

Enterprise social network systems (ESNS), also known as Enterprise 2.0, for instance Microsoft Yammer etc. imitate characteristics of Web 2.0 tools except these are used only within organizational boundaries. ESNS helps employees to capture and disseminate internal knowledge which ultimately enhance organizational learning, processes and outcome (Aboelmaged 2018; Qi and Chau 2018)

4.3 Decision Support Systems

Decision support systems are used to apply the acquired knowledge. Information technologies has changed traditional decision tacking actions. Now organizations use technology supported systems to take better informed decisions about their counterparts, business strategies and goals. These systems support organizations to learn quickly and adopt rapidly to the changes; customer behaviours, supply chain, competitive forces, resource management etc., that are happening around its turbulent business environment (Bhatt and Zaveri 2002). We have found CRM and Big data analytical systems as a decision support system in our survey.

Customer relationship management system works as knowledge management tool within organization. CRM system provides customers information orientation, their behaviour towards product buying, loyalty, purchase patterns etc., which help top management to take informed decision about sales and marketing. The informed decisions, equipped with customer knowledge acquired through CRM system, improve organization performance (Stein and Smith 2009).

Big data is considered organization asset upon which analytics, through specialised tools, are applied to generate new knowledge. Big data analytics enhance organizational learning and facilitate organizations to improve their decision making activities and gain competitive advantage over their contenders (Calvard 2016; Erickson and Rothberg 2014; Fredriksson 2018; Kabir and Carayannis 2013; Khan and Vorley 2017; Lambrou 2016; Le Dinh et al. 2016; O'Connor and Kelly 2017). Predictive knowledge can be extracted from big data which improves organization's decision making capability. Sumbal et al. (2017) have illustrated the concept by an exploratory study in oil and gas industry. Similar

demonstration has also been reported by (Khan and Vorley 2017). Different organizational learning models are used to generate knowledge from big data. Philip (2018) used SECI model to exemplify the knowledge creation from big data. Other model of knowledge creation from big data are proposed by (Chan 2014; Izhar and Shoid 2016; Noh 2018).

5 Organizational Learning for Information Technology

Organization learning helps organizations in various ways to implement, utilize, govern and assimilate information technology. Figure 3 depicts how organizational learning facilitates information technology. Organizations that uses information technology in accordance with methods of organization learning have comparatively more advantage over organizations that have no organization learning initiative (Takian et al. 2014). Usually knowledge is embedded into tasks, members and tools of organizations and are considered knowledge repositories. Organizational learning seeds processes, routines, structures and capabilities within organizations that maximize understanding of implementation, utilization and management of information technology (Argote and Hora 2017).

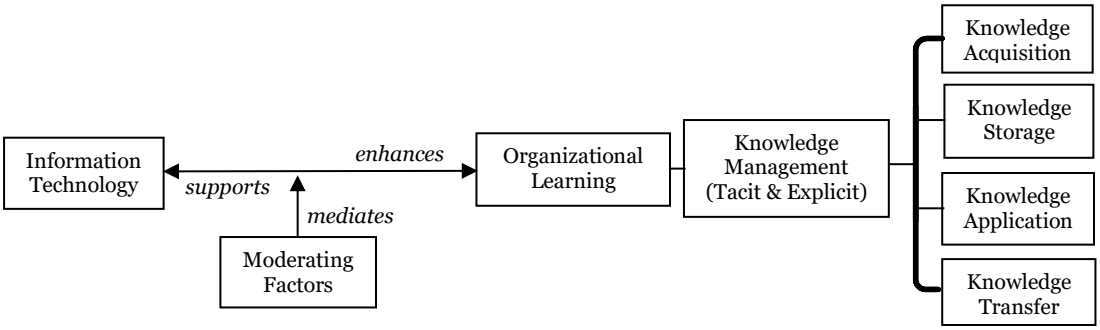

Figure 3: OL for IT (source: Developed for this research)

It acts as a catalyst to increase efficiency and effectiveness of an information system (Louis Raymond 2000). Vishwanath and Sankaranarayanan (2017) have demonstrated role of organizational learning in customer value creation through information technology supported CRM. Organizational learning enhances quality of customer data, contributing into better decision making regarding product and services, interactive customer marketing strategies and tactics, that fuels organization performance (Peltier et al. 2013). Similar concept regarding organizational learning as success factor of customer relationship management system have been reported by (Stein and Smith 2009). Organizations find implementation and post implementation of contemporary enterprise resource planning systems (ERP) a big challenge because of their complexity. Tomblin (2010) has proved organizational learning as a facilitator in deployment of ERP system. He has exemplified use of organization learning as a basis to understand and learn two phases of ERP; implementation and post implementation. Exploration and exploitation are two main dialects of organization learning that have different impact on of information technology in context of organization performance. There is trade-off between these two concepts and organizations need to keep balance in them for better organization performance (Hunter 2003).

6 Factors Affecting Interplay between IT and OL

In this section, we have included only those articles that fulfil inclusion criteria of our study and indicate factors that influence relationship of information technology and organizational learning. Following figure 4 represents the factors which affects relationship of IT and OL.

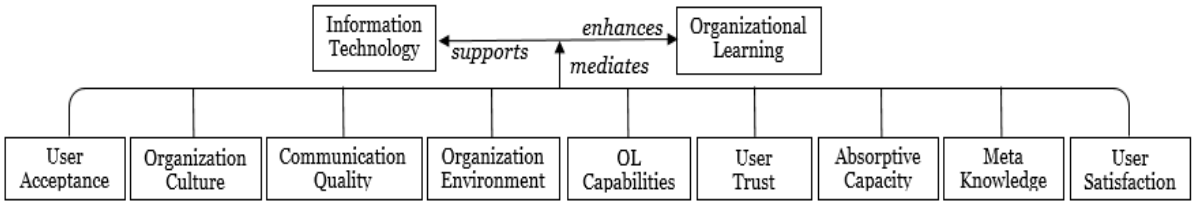

Figure 4: Factors affecting interplay between IT and OL (source: Developed for this research)

Absorptive capacity is ability of an organization to understand value of new external knowledge, assimilate the knowledge and apply it into its business activities. During implementation of new information technology, if the organization has no absorptive capacity then it can't learn to get

maximum benefits of the technology (Dong and Yang 2015). Marabelli and Newell (2009) have explained role of absorptive capacity in organizational learning and implementation of ERP system in a worldwide organization.

Benefits of contemporary technologies such as Web 2.0, CRM, ERP etc. are manifested in better knowledge management, learning and performance only if employees have trust on technology or among each other (Brockman et al. 2017; Simeonova 2017).

The organization environmental conditions affect organizational learning, exploration and exploitation, when employees make use of information technology. Information technology contribute to organizational learning differently in environmental turbulence and organization turnover (Kane and Alavi 2007).

Meta knowledge, knowledge exchange and knowledge structure, is more important than technical or professional competences to use an information system. If employees have no knowledge about contents structure of information system then it becomes itself a learning barrier. Therefore, employee 'knowledge about contents, characteristics of co-workers, cooperation between employees and self-competences works as a success factor in implementation of an information system and motivate learning process (Herrmann et al. 2003; Hrastinski and Monstad 2014).

Although organization leaning helps employees to gain skills and knowledge to use information technology but organizations cannot achieve required results if the employees are reluctant to accept that technology. Lee et al. (2013) investigated the influence of user acceptance on IT and concluded that user acceptance played a vital role to accept a new technology among operating room nursing staff.

User satisfaction is an important measure of effectiveness of an information system. It plays a critical role in learning, use or implementation of an information system within an organization. Organization can't achieve its goals if its employees are not satisfied with the technology being implemented, thus limiting its role in organizational learning (Goswami et al. 2006).

Reciprocal relationship between information systems such as transactive memory information system and knowledge management is mediated by communication among employees of an organization. Timely, useful and thoughtful communication among employees foster knowledge sharing within organization (Chen 2014).

Organization culture plays an important role to facilitate organizational learning and information technology . It has great effects on implementation, utilization and governance of information technology for knowledge sharing (Ruppel and Harrington 2001). It works as an instigator of knowledge acquisition and sharing ultimately fostering organizational learning and performance (Chuang et al. 2013). An organization can't survive and innovate if it has no culture to learn about new market trends, emerging technologies and strategies of its rivals (Al-Tameem 2004; Shao et al. 2017).

Organizational learning capabilities are known as the management practices or conditions within organization which may foster organizational learning . Continuous learning is necessary for organizations for their survival. OLC help organization to implement and utilize information technology for better decision making, to gain competitive advantages and enhance its performance (Nwankpa and Roumani 2014).

7 Conclusion

We have consolidated a large body of knowledge on information technology and organizational learning that reveals intertwined nature of these two disciplines and validates previous studies of their interplay. For IT to OL research stream, we conclude that information technology enhances organizational learning or its dimensions in many ways such as knowledge organization systems help for knowledge storage and retrieval, communication and collaborative systems make knowledge acquisition and dissimilation efficient, and decision support systems promote application of knowledge, thus improving overall business processes and gaining competitive advantages.

For OL to IT research stream, we believe that organizational learning supports deployment, implementation and assimilation of information technology. Organizations can increase their performance, innovate and gain advantage over their counterparts only if there is some mechanism to capture, store and share knowledge through information technology. This mechanism is provided by organizational learning in the form of single loop learning, double loop learning, 'community of practice' and SECI model.

Our survey has also identified some influential factors such as organization culture and environment, user acceptance and satisfaction, meta-knowledge, absorptive capacity that need to be considered while implementing information technology in an organization. There are also some limitations of our research. First, we have used only one, albeit very authentic, database of record, Scopus. Second, we have included only peer reviewed articles of a specific period. Therefore, there is possibility of missing some relevant research, however large inclusion of body of knowledge into our survey has reduced the chance to challenge our results. This paper highlights some gaps in the literature that work an opportunity for future research such as relationship of big data and artificial intelligence with organizational learning. As most of the literature indicates that organizations fail in successful implementation of information systems, therefore an empirical investigation of the interaction between big data and organization learning will open new doors for organizations to deploy, implement and assimilate big data systems effectively. We also hope that such kind of research will act as a classification model to find cause and outcome of the relationship of big data and OL. Relationship and gaps of the theories reported in this paper, provide an opportunity for IS researcher to conduct future research.

Directions for Future Research

Some future directions reported in surveyed literature are: Firstly, the researchers, in IT to OL research stream, commends further inquiry to seek interaction of information technology with different sources of organizational learning e.g. individual learning. They also solicited to explore enabling role of different information intensive techniques such machine learning and data mining into organizational learning.

Secondly, in the reviewed literature of OL to IT stream, researchers seem to be interested to find exclusive impact of each source of OL on implementation of various information systems such as e-commerce applications. Role of OL for implementation (pre implementation vs post implementation) of distinct information systems such as ERP and CRM is also suggested for future exploration.

Finally, although there are many factors reported in the literature that affect interaction of information technology and organizational learning, however additional factors for instance manager's ambiguity regarding information technology or competitors, relational capital, organization structure, management style and reward system in organization need further inquest. These factors are very important because they may cause low performance of information technology and hindrance in organizational learning and hence draw attention to be addressed. Reverse effect of information technology and organizational learning on such factors is another future research direction that is reported in the literature.

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